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THE ZOÖLOGY OF THE HORN EXPEDITION.

E. H. EATON.

A WORK of considerable importance, which has received too little attention in this country, is Professor Baldwin Spencer's *Report of the Horn Expedition to Central Australia*, published in September, 1896. The author's conclusions regarding the affinities of the Australian fauna are of vital importance, especially concerning the Antarctica theory, and a brief reference to the expedition, with a statement of its main results, may be of interest to readers of the *Naturalist*.

The object of the expedition was to explore the country about the McDonnell Ranges, which lie just south of the tropic between 129° and 135° east longitude. Leaving Adelaide in the beginning of May, 1894, the party proceeded by rail to Oodnatta, where the journey of 2000 miles by caravan was begun. There were five specialists in charge of the different departments, besides two collectors, a cook, and men to care for the camels. Mr. Horn, who equipped the expedition, accompanied it for a part of the journey in a carriage drawn by a team of camels.

The course lay for the most part through the dry country in the great Finke Basin, or Larapinta Land. Sandy deserts, "gibber" plains, dry river channels, with occasional water holes, scanty brush, and dried porcupine grass offered a monotonous scenery and poor prospects for collecting. By day the unclouded sun drove all but the hardiest creatures from the blistering sands; at night the temperature often fell many degrees below the freezing point. A yard away from the water holes the earth was parched and unfit for the habitation of animals or plants. In this region, however, during the rainy season, there is a wonderful change of scenery. Vegetation grows with amazing rapidity. Frogs, lizards, and mollusks creep from their hiding places, and their swarming descendants soon cover the country. Fishes and crustaceans are scattered by the swollen rivers from

the water holes where they have survived the dry season. Insects increase with the vegetation on which they feed, and the region is invaded by numerous birds which find their favorite food. Even rodents and marsupials immigrate sometimes in vast numbers from the surrounding regions.

But soon this brief season is past, and only the hardiest and those with special equipment to endure the ensuing drought and extremes of temperature survive the long dry season.

There was little opportunity for collecting specimens, except for an hour or two each day, when halting for food and water. If a rare lizard were seen hurrying away as the march was proceeding, before the unwilling camel could be compelled to fall back from its companion and kneel for dismounting, the agile lizard had made good its escape. Thus, only the twenty days of "spelling" in camp out of 125 days in the field were really available for taking specimens.

Besides several orders of invertebrates which had not been worked over when the report was published, there were 603 species of animals collected by the expedition, of which 171 species were new to science. The following is Professor Spencer's table of species collected:

MAMMALIA.	NO. OF GENERA.	NO. OF SPECIES.	NO. OF NEW SPECIES.
Carnivora	1	1	0
Chiroptera	2	2	0
Rodentia	3	11	3
Marsupialia	16	24	6
Monotremata	1	1	0
Aves	83	100	5
Reptilia	33	44	12
Amphibia	4	6	1
Pisces	5	8	5
Mollusca	20	38	21
Arthropoda	229	357	117
Vermes	1	1	1
	398	593	171

Several interesting observations on the fauna and flora of the center may be noted. The characteristic plants have their sur-

face adapted to prevent the evaporation of moisture, and their seeds can survive a long exposure, but germinate very rapidly as soon as the moist season arrives. The animals are such as can travel long distances with ease, like the dingo and the kangaroo, or can subsist on the dews of early morning. Some, like the burrowing frogs and mollusks, hide away from the withering sun, and others produce eggs which will not develop until after the mud in which they have been deposited dries up.

Professor Spencer thinks there is little attempt at protective coloration, in the struggle for existence, except in a general way. Nature seems to devote all her energies to the production of eggs which will develop precociously. The young, especially of insects, seem impelled to feed ravenously, and reach maturity before the favorable season is past.

As a result of the variable seasons, many species show a considerable discrepancy in size, individuals reared in successive good seasons being unusually large, while those growing in a succession of poor seasons are small. In one species, *Phascologale cristicauda*, the length of the head and body of the smallest adult male was 136 mm.; of the largest, 220 mm. The relationship of the fauna of the center to that of the surrounding regions is one of the strongest points in determining the probable source of Australian marsupials. The author divides the twenty-four species of the center into three main groups:

1. Those of continental distribution: *Trichosurus vulpecula*, *Sminthopsis murina*, *S. crassicaudata*, *Perameles obesula*.

2. A larger number, characteristic of the inland portion of eastern Australia, and of the south and west: *Macropus robustus*, *M. rufus*, *Petrogale lateralis*, *Onychogale lunata*, *Lagorchestes conspicilatus*, var. *leichardtii*, *Bettongia lesueuri*, *Chæropus castanotis*, *Phascologale calura*, *P. cristicauda*, *Dasyurus geoffroyii*, *Antechinomys laniger*, *Myrmecobius fasciatus*.

3. Those which as far as now known are peculiar to the central region: *Peragale minor*, *P. leucura* (probably), *Perameles eremiana*, *Sminthopsis psammophilus*, *S. larapinta*, *Phascologale macdonnellensis*, *Dasyuroides byrnei*, *Notoryctes typhlops*.

Professor Spencer calls attention to the fact that there is no indication of primitive monotremes of marsupials characteristic

of western Australia, and that the monotremes and polyprotodonts diminish in importance as we pass northward and northward from southeastern Australia.

The birds collected range over the southern portion of the continent from east to west, with a slight preponderance of western forms. The reptiles show a marked affinity with the west and north. The Amphibia, with the exception of *Hyla rubella*, are allied to those of the southeastern portion. The fishes are related to those of the coastal districts, and not to those of the Murray River system; they probably were derived from the north. The mollusks are related to the west, and, in a slight degree, to the eastern interior. The other invertebrates in the center are too imperfectly known to furnish reliable generalizations.

As a result of his investigations, Professor Spencer draws some highly interesting conclusions in respect to the faunal affinities of the island continent and the geologic changes that have combined to establish this remarkable life here. These views, while they differ in some marked particulars from those of Darwin, Wallace, and Lydekker, are, we believe, in line with the very latest scientific developments. They may be stated briefly as follows:

1. Probably a very ancient connection with southeastern Asia, existing partly in the western and partly in the eastern portions of the island, when these were separate land masses, furnished the original inhabitants, which are represented to-day, perhaps, by such forms as *Xanthomelon*, *Peripatus*, *Ceratodus*, *Amphibolurus*, *Moloch*, and the families *Pygopodidæ*, *Meliphagidæ*, and *Trichoglossidæ*.

2. A great marine area, in which the Upper Cretaceous rocks of the Rolling Downs were deposited, completely separated the western and eastern portions and isolated the higher Steppes from the ancient region further west.

3. Across the Torres Straits a connection in late Cretaceous times with a Papuan area, and with Polynesia and the New Zealand region, accounts for the distribution of *Microphyura*, *Acanthodrilus*, and the struthious birds of Australia and New Zealand; also for the introduction of the *Paradiseidæ*, *Megapo-*

didæ, Rana, Heteronota, Physignathus, Perichæta, and from the Austro-Malayan area, and later, for the passage northward of monotremes and marsupials. The union with New Zealand was severed, and only that with New Guinea probably remained at the time when the Prototheria and Metatheria had become established on the Australian continent.

4. Perhaps in later Cretaceous times, and certainly not later than the Miocene, a union with South America by way of Tasmania and Antarctica resulted in the introduction of such forms as Gundlachia, Geotria, Galaxias, Haplochiton, Aphritis, and the Cystignathidæ, Marsupialia, and possibly the Monotremata.

5. The union of eastern and western Australia, and the formation during the Tertiary period of a great lacustrine area and of pluvial conditions in the interior, favored the development of the gigantic diprotodont and struthious forms of the Pliocene period.

6. The elevation of the coastal range barrier, which was much higher in Tertiary times than at present, prevented the free intermingling of the coastal forms with those of the inland regions.

7. The isolation of the Australian continent, by the obliteration of the land connections referred to, has preserved to a great extent its unique animal life. The union with Tasmania was doubtless severed prior to the Pliocene times, when the dingo and large diprotodonts existed in Australia.

8. The desiccation of the interior in Post-Pliocene times partly replaced and partly intensified the mountainous barrier near the coast, and combined with this to separate the desert fauna from that of the well-watered districts.

After careful study of the animals collected by the Horn Expedition, and comparison with specimens from the remainder of the continent, Professor Spencer concludes that western Australia has no claim to the title "Autochthonian," as far as the higher forms at least are concerned. He discards this term, which was introduced by Professor Tate with reference to the flora. The Euronotian region of the same author he finds made up of two well-defined areas, each of which is marked by characteristic animal forms, and prefers to divide the Australian region as follows :

1. The Torresian subregion. This is the Papuan subregion of Professor Hedley, but Professor Spencer prefers the name Torresian, as less liable to lead to confusion, and as indicating the former land connection. It includes Papua and north and northeastern Australia as far south as the Clarence River.

2. The Bassian subregion, which comprises the eastern and southeastern coast region, and Tasmania. The name indicated the route by which "the South American contingent must have passed."

3. The Eyrian subregion, including all the interior, southern, and western part of the continent. It is separated by the coastal ranges from the Torresian region on the northeast, and from the Bassian region on the southeast.

The theory of a former connection between Australia and South America by means of a great southern continental area now seems thoroughly established. Mr. Wallace thought the relationship between the marsupials of the two countries, and between several families of birds and reptiles, too general to be accepted as direct evidence. He admitted, however, that cystignathous frogs, several genera of fresh-water fishes, and one genus of snail were undoubtedly transported from one region to the other, but thinks this transportation was by means of floating ice. Mr. Lydekker, in his *Geographical History of Mammals* (1896), still maintained that the evidence was too scanty to show in what latitude the connection occurred. He admits that the discovery of dasyuroid marsupials in the Tertiary of Patagonia indicates a former communication, and he points out the importance of the determination of the rocks recently brought back by the *Antarctic* as indicating a continental area; but he thinks the presence of Australian types of rats in the Philippines "is of the utmost importance in respect to Australia receiving its mammalian fauna from southeastern Asia"; and he believes that this fauna entered the island by way of New Guinea.

Professor Spencer calls attention to the fact that polyprotodont forms decrease in importance toward the north and northeast in Australia (which is the opposite of what should be the case if Professor Lydekker's theory is the true one), and pointedly remarks that Australian rats in the Philippines do not prove

that the marsupials came from the north, any more than it proves that the fish *Galaxias* is an immigrant from Asia. At the same time Mr. Lydekker admits that the rats are comparatively recent immigrants, and that because of their small size they may have been introduced without direct land connection.

After reading Professor Spencer's summary of evidence, and examining an atlas of the southern circumpolar regions, one is forced to admit the extreme probability of this ancient connection of southern lands, including South America, Australia, and New Zealand. We may also add Africa, in the light of Mr. Spencer Moore's paper on the origin of the Australian flora, published in *Natural Science*, September and October, 1899.

Mr. Moore speaks of this land connection practically as an axiom of science. Dr. Moreno's publication in *Nature*, Aug. 4, 1899, of the discovery of *Miolania* in the Tertiary of Patagonia, also of *diprotodon* and other marsupials in the same deposits, adds evidence on the subject which is well-nigh conclusive.

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